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β-decay of 68Mn: Probing the N=40 Island of Inversion

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The breakdown of traditional magic numbers predicted by the shell model gives insight into the underlying nuclear interactions and acts as a test for existing models. Islands of inversion (IoI) in the nuclear landscape are characterized by the presence of deformed intruder ground states instead of the normal configurations predicted by the shell model. In the N=40 region, the relatively large energy gap separating the pf shell from the neutron $g_{9/2}$ orbital points towards a strong sub-shell closure at N=40 which has been supported by the observation of a high-lying 2^+ state and low B(E2) value in ^{68}Ni (Z=28) [1]. However, systematics of E(2^+) and B(E2) values have indicated a sudden increase in collectivity below Z=28 when approaching N=40, seen in the rapid drop of E(2^+) in Fe (Z=26) and Cr (Z=24) isotopes [2]. This increase in collectivity is thought to be due to the neutron occupation of intruder states from a higher shell, similar to the IoI around N=20 [3]. Recent studies also suggest the occurrence of a new IoI at N=50 and a proposed merging of the N=40 and N=50 IoIs [4]. Spectroscopic information of the Fe, Co, and Ni isotopes will be crucial to understand the structure of nuclei near and inside the N=40 IoI. An experiment was performed at TRIUMF-ISAC using the GRIFFIN spectrometer that utilized the β and βn decay of ^{68}Mn to populate excited states in ^{67,68}Fe, ^{67,68}Co and ^{67,68}Ni. Preliminary results from the analysis which includes a greatly expanded ^{68}Fe level scheme will be presented.
[1] O.Sorlin et al. PRL (2002)
[2] S.Naimi et al. PRC (2012)
[3] S.M.Lenzi et al. PRC (2010)
[4] C.Santamaria et al. PRL (2015)

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Please select: Experiment or Theory

Experiment

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